NEWSLETTER

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AUSTRALIAN SOCIETY FOR LIMNOLOGY

The Australian Society for Limnology is an association of over 400 people with professional or amateur interests related to Australian inland waters. Since its inception in 1961 the Society has played an important role in fostering limnological work in this country. The ASL promotes liaison between limnologists in academic, private and governmental institutions and has a vested interest in the conservation of aquatic and related resources. Annual congresses are held near centres of limnological interest, and the programme includes scientific sessions, field excursions and social activities.

The ASL produces a *Newsletter* with notes on activities, articles of general interest, book reviews and congress announcements; a *Bulletin* of original scientific papers and occasional *Special Publications*. A further publication id the *Directory of Australian Limnologists*.

Membership applications are welcomed; four classes of subscribing membership are available:

Ordinary members	$10.00 p.a.
Student members	$4.00 p.a.
Institutional members	$10.00 p.a.
Sustaining members	Fees on application

Members are entitled to receive the Australian Journal of Marine and Freshwater Research at the reduced rate of $12.50 p.a.

Membership subscriptions cover the period 1 July to 30 June but subscriptions for Aust J. mar. Freshwat Res. cover the period 1 January to 31 December.

Enquiries relating to membership should be addressed to:

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Secretary, ASL.,
c/- Department of Chemistry,
Caulfield Institute of Technology,
P.O. Box 197,
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ASL Executive 1980-81

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University of Tasmania,
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Hobart, Tasmania,
Australia 7001.

EDITORIAL

A quick review of earlier issues of the Newsletter will reveal that each editor has exerted an individual style on the publication. My 'style' must be immediately obvious - I've reduced the size of the Newsletter. This new A5 format has been adopted for several reasons. Firstly, the Gestetner machine is an extinct beast at the University of Tasmania. Therefore, as the printing has to be done on an off-set machine it seemed appropriate to save paper (and trees!) and hence the Society's funds. Further, the smaller format may also be cheaper to post and it will definitely stand on the bookshelf more efficiently.

I hope that the changed format will not be taken to indicate a changed role for the Newsletter. The Newsletter is the 'house' journal of the Society. It is not a formal publication in the sense of the Bulletin. I hope that members will continue to use the Newsletter to inform, to fly kites, to beg and even to gossip (no slander please). The success of the Newsletter depends on a supply of material being forwarded to the Editor (especially to this editor in his isolated editorial office at 43°S). On this point I should like to thank my two immediate predecessors as editor, Sam Lake and Bill Williams, for much of the information used in this issue.

Another change I propose to instigate is to bring the 'Newsletter year' in line with the 'calendar year'. Accordingly, there will be only two issues of Volume 18: this issue and another in December. Thereonafter there will be three issues per volume published approximately in early April, August- and December. I also intend to abandon the practice of using the seasons (spring, summer, etc) to indicate the time of publication and instead to use months.

This issue is mainly taken up with abstracts from the Annual Conference. This is the usual role for the mid-year issue. In other issues I hope to enlarge the book review section and to have summaries of the activities of various departments and institutions.

A 'Letters to the Editor' section might also be fruitful. Let me, and therefore members, know what you think of the Society and its activities. The executive get some feed-back at the Annual Conference but work in isolation of the membership for the rest of the year.

If you have any comments on the new format, favourable or otherwise, please let me know. The Newsletter editor should be responsive to the views of members.

Robert White.

NEWS & VIEWS

1981 ASL Conference

The 1981 Annual Conference of the Australian Society for Limnology will be held at Narooma, N.S.W. from 22-25 May 1981. Further details will be given in the next issue of the Newsletter.

ASL Subscriptions now due

The 1980/81 ASL subscription is now due and a letter to this effect is enclosed with this Newsletter. Members wishing to subscribe to the Australian Journal of Marine and Freshwater Research are reminded that they must pay the subscriptions before the end of the year.

Please help to lighten the load borne by the Secretary and Treasurer by paying your subscriptions promptly.

International Newsletter on Regulated Stream Limnology

A new newsletter for scientists working on regulated lotic habitats. Volume 1 was published in 1980 and contains a great deal of topical and useful information. The annual subscription is US$2.00 and full information can be obtained from the Australian Associate Editor, Dr. K.F. Walker, Department of Zoology, University of Adelaide, Adelaide, Adelaide, S.A. 5001.

Eighth International Symposium on Ostracoda

Applications of Ostracoda to Economic and Scientific Problems

The Eighth International Symposium on Ostracoda will be held in Houston, Texas, U.S.A., on July 26-30, 1982. This interdisciplinary colloquium will feature invited and contributed papers, workshops and discussion sessions, visits to local scientific laboratories, and other activities. Meetings will be held in the Continuing Education Center on the University of Houston Central Campus. Participants may be accommodated in the University student dormitories or in the Hilton Hotel on campus.

The theme of the conference emphasizes applied ostracodology, the "state of the art". Papers concerning the use of Ostracoda for biostratigraphy, paleoecology, paleo-oceanography, pollution-control, environmental management, fisheries, and the like, will be especially welcome. Review papers are also solicited that summarize the present state of our knowledge for a major question in ostracode biology, evolution, ecology or zoogeography. Other suitable biographies of eminent workers, or a brief summary of the past and present activities of an organization or nation, especially one not previously represented at these symposia.

Further information from: Dr. Rosalie F. Maddocks,
Chair, Organizing Committee,
Eighth International Symposium on Ostracoda.

Geology Department,
University of Houston,
Houston, Texas 77004. U.S.A.

Fifth ASTM Symposium on Aquatic Toxicology

The 5th American Society for Testing of materials Symposium on Aquatic Toxicology will be held in Philadephia, U.S.A. on 7-8 October 1980. Information from: J.G. Pearson, U.S. Army Medical Bioengineering Research and Development Laboratory, Ft. Detrick, Frederick, MD21701, U.S.A.

Cainozoic Evolution of Continental South-East Australia.

This conference will be held at Canberra College of Advanced Education from 26 to 30 November 1980. It is sponsored by the Commonwealth Territories Division of the Geological Society of Australia and the Bureau of Mineral Resources, Geology and Geophysics. There will be formal sessions workshops and excursions. Further information from Dr. G. Taylor, CECSEA '80, School of Applied Science, CCAE, P.O. Box 1, Belconnen, A.C.T..2616.

Australian Water and Waste Water Association - 9th Federal Convention

The AWWA 9th Convention will be held in Perth, W.A. from 6 to 10 April 1981.

Further details from:-

Convention Secretariat,
A.W.W.A. Federal Convention,
C/- W.A. Division,
The Institution of Engineers, Australia,
712 Murray St.
WEST PERTH, W.A. 6005.

Ranatra - information and material required

Paul Bailey, a Ph.D. student in the Zoology Department, University of Adelaide is working on the biology of the needle bug Ranatra (Heteroptera:Nepidae). He would like to make contact with people able to send him specimens, preferably alive, and/or other material/information concerning Ranatra. Living animals can be easily shipped in a suitable container with some damp grass or water weed. Paul is especially keen to obtain specimens from Western Australia and Queensland.

Offer on 'Australian Freshwater Life' closes.

The discount to members on the price of Bill Williams' 'Australian Freshwater Life" is now closed. Please do not forward any further orders to the Secretary. Copies should now be purchased through your normal book supplier (see this issue for review).

IPPCCE Newsletter

The International Project on Paleolimnogy and Late Cenozoic Climate Newsletter No.2 was distributed early this year. It is a joint publication by the SIL Working Group. The newsletter is attractively produced and gives an excellent insight into ongoing projects around the world. The newsletter is edited by:

S. Horie,
Institute of Paleolimnology and
Paleoenvironment on Lake Biwa,
Kyoto University,
Takashima,
Shiga-ken, 520-11, Japan.

ASL CONFERENCE REPORT

The 1980 Annual Conference of the Soceity was held in Queenstown Tasmania. A 'select' group of 80 committed members attended and enjoyed a most successful meeting. About 30 members relived the pioneering era of trans-Bass Strait air travel by flying in a DC3 from Essendon to Queenstown. This service may lack the 'plastic' charm of TAA or Ansett but more than compensates with friendly informality.

The sessions were held in the excellent facilities of the Queenstown Central Primary School. The Tasmanian members of the Executive (Tyler, Richardson and White) ran the sessions with clock-work precision and proudly report only one failure with the audio-visual equipment (c.f. Tallangata). This was caused by no less a figure than the President (Tyler) in an attempt on the world record for the number of slides shown in 3 mins - but for machine failure he would have taken it with ease.

The Annual Dinner was held at the Commercial Hotel where members were treated to an excellent meal in very agreeable surroundings. Following the dinner members had a choice of entertainment. The more sedate (sober) took in two excellent films on the Franklin/Gordon Rivers whilst the others cheered on their team in the F.A. Cup Final live from Wembley. And if you still haven't heard, the right team won (West Ham 1, Arsenal 0).

The proposed scenic flight over the western and south-western Tasmania had to be cancelled due to low cloud so the majority of delegates took the cruise around Macquarie Harbour and up the Gordon River. Despite the grey weather, spirits were high and many appreciated the chance of seeing this splendid river.

The 1980 Conference again proved that a venue away from the 'south-east mainland corner' can be a success and serves to reinforce the notion we are an Australian society, and not one based in the mainland south-eastern capital cities.

A SURVEY OF THE FRESHWATER INVERTEBRATES OF THE LOWER GORDON REGION.

Alastair M.M. Richardson, Department of Zoology, University of Tasmania.

The Lower Gordon River Scientific Survey was sponsored by the Tasmanian Hydro-Electric Commission and was carried out in the summer seasons 75-76, 76-77, 77-78. The survey was based on transect lines cut across the river valleys, but many of the freshwater collection were made away from these. The freshwater invertebrate survey had three components: (1) an extensive survey of all freshwater invertebrates, (2) an intensive survey of the riffle fauna of the Gordon River and its major tributaries and (3) an investigation into the distribution of burrowing crayfish.

The invertebrates survey covered 174 sites in all habitats except the deep rivers. To date 13 new species have been identified. A cluster analysis of an edited data set showed clear groupings of species-rich big river riffles and the fauna of yabby burrows, small pools and seepages, but failed to make any intelligible division of the mass of sites.

The burrowing crayfish study showed that one species and one sub-species were geographically restricted in the region, while the three sub-species of Parastacoides tasmanicus showed quite distinct preferences for soil drainage conditions.

The implications of the study for future development are (1) the area is very important biologically, (2) the large rivers are much more faunally-rich than previously supposed, (3) the flat, peat-filled valley floors represent an important, but shrinking habitat and (4) the area is not homogeneous and may include a local zoogeographic transition zone.

THE LITTORAL FAUNA OF THE SERPENTINE IMPOUNDMENT

P.S. Lake, Department of Zoology, Monash University.

The Serpentine Impoundment inundated Lake Pedder and Lake Edgar. Pre-impoundment studies of these two lakes showed that they possessed different faunal communities and that Lake Pedder possessed a highly endemic fauna and a distinct psammon comunity.

By 1974, the inundation of Lake Pedder and Lake Edgar was complete. Sampling of the littoral fauna of the Serpentine Impoundment has been carried out anually at 12 sampling sites since 1975.

Including the 1979 survey, 42 taxa of macroinvertebrates have been collected, with a leptocerid trichopteran (Oecetis sp.) being the most abundant taxon at most sites for all years. Besides this leptocerid trichopteran, other abundant constituents of the fauna include Amphipoda

(Austrochiltonia australis), chironomids (especially Kiefferulus sp. and Dicrotendipes sp.) and hydracarinids (especially Piona sp.).

In 1977 both the greatest taxon richness (T = 31) and greatest numerical abundance occurred. With the exception of four gently sloping, semi-exposed sites, taxon diversity ($\bar{H}$ and/or Δ) declined with time. Taxon turnover rate (λ) for most sites increased with time while succession rate (σ_s) (see Lewis, W.M. 1978, Am. Nat. 112: 401-414) was either constant or declined. In general the littoral fauna at each site is becoming simpler with time and succession, in its usually understood context, does not appear to be occurring. Of the taxa recorded in the psammon community of Lake Pedder, none are to be found in the littoral fauna of the Serpentine Impoundment. The littoral fauna of the impoundment is quite different from that was found in either Lake Edgar or Lake Pedder.

This work could not have been performed without the generous support of R. Mawbey, D. Morton, A. Richardson, D. Coleman, P. Allbrook, R. Norris, R. Sloane and R. Swain.

SOME CONCEPTS AND METHODS IN MODERN PHYSICAL LIMNOLOGY

John, M. Brubaker, Environmental Dynamics, Department of Civil Engineering, University of Western Australia.

Features of a combined program of field, laboratory and theoretical research into various aspects of physical limnology will be presented. A one-dimensional lake/reservoir simulation model exemplifies the approach that has been adopted, namely, to identify the important fundamental physical processes and then to define their dynamics well enough to permit an appropriate representation in terms of environmental parameters. This model has proved successful in applications to several lakes and reservoirs and has received considerable international attention. Yet present understanding of transport phenomena is still inadequate to, for example, study in detail the biological-physical interactions in ecosystem dynamics, or to incorporate a water quality model into the reservoir simulation. Therefore, a major effort is underway to investigate mixing processes and their parameterization. Facilities for field work will be described, particularly the research vessel Djinnang, equipped with state-of-the-art instrumentation for navigation, echo sounding, and continuous profiling of several mean field variables as well as temperature microstructure. A brief description of laboratory facilities, serving jointy a research and teaching function, will also be presented.

THE USE OF UNDERWATER IRRADIANCE MEASUREMENTS TO OBTAIN INFORMATION ON THE SCATTERING PROPERTIES OF NATURAL WATERS.

J.T.O. KIRK, CSIRO, Division of Plant Industry, Canberra.

An earlier theoretical analysis had shown that the value of $2R_a K$ for a water body, where R_a is the asymptotic (maximum) value of underwater irradiance reflectance and K is the vertical attenuation coefficient of irradiance, should be equal to b_b', a new scattering parameter of the water, referred to as the asymptotic backscattering coefficient. It has now been shown for five water bodies in the southern tablelands of New South Wales that there is a linear relationship between the nephelometric turbidity (a measure of 90° light scattering) determined on water samples, and the value of $2R_a K$ obtained from *in situ* irradiance measurements, thus supporting the interpretation of this latter parameter in terms of the scattering properties of the water. It is proposed that b_b' (i.e. $2R_a K$) provides a useful alternative measure of light scattering by different waters.

Theoretical calculations have been carried out to determine the ratios of the asymptotic backscattering coefficient, b_b', to the normal back- and total scattering coefficients (b_b and b), for different types of water. The relationships which have been found may be used to obtain approximate values for these fundamental, but hard to measure, scattering coefficients.

PLANKTON COMMUNITIES OF MURRAY-DARLING RESERVOIRS

Russ Shiel, Zoology Department, University of Adelaide.

Abstract: Community composition and population densities of limnetic zooplankton of headwater reservoirs of the Murray rivers are related to trophic status. Downstream impoundments, which act as nutrient sinks, have complex communities. Seasonal incursions by characteristic billabong forms are common. Polymorphism of plankters in response to environmental variables is discussed.

HYDRODYNAMICS OF PSEPHENID LARVAE-WATER PENNIES

J.A. Smith and A.J. Dartnall, Zoology Department, University of Tasmania.

Psephenid larvae, or waterpennies, are distinctive members of the freshwater benthos. It has been suggested (Hynes, 1970) that the flattened form of psephenid larvae allows them to live within the boundary layer on the upper surface of shores in rapidly flowing streams. To investigate the actual flow regimes that may be experienced by larvae flow patterns around larvae were obtained using a flow tank and various

tracer dyes.

Dye patterns obtained under laminar conditions revealed that larvae are streamlined. Such a streamlined form minimises drag forces and allows larvae to maintain position with minimal expenditure of energy. Experimentation also revealed that larvae can exert a powerful grip on the substrate using the thoracic legs.

Under normal stream conditions, turbulent flow predominates, however within the turbulent boundary layer a thin laminar-or Viscons sub-layer always exists in the immediate vicinity of the substrate.

Dye patterns indicated that the particular shape of the psephenid larvae modifies the laminar sub-layer, increasing the thickness of the sub-layer, to include the body within it. However under such conditions respiratory exchange across the sub-layer must be limited to the slow rate of molecular diffusion. Larvae in the Australian genus, Sclerocyphon, have overcome the contraints of this situation by creating their own respiratory current with a pair of anal tracheal gills. During ventilation the actively pumping gills are extruded from beneath the last abdominal tergite. Dye patterns revealed that such pumping creates a mixing area at the rear of the larvae body which does not increase drag forces on the body and greatly enhances respiratory processes and waste removal.

At higher stream velocities the thickness of the laminar sub-layer is reduced considerably, under such conditions we suggest that boundary layer control by suction is employed by the larva. The spaces between the lateral laminae appear to act as slots through which a small amount of boundary layer fluid can pass. Such a mechanism would result in a thinner, but more stable, attached boundary layer over the larva and thus drag forces on the larva would still be kept to a minimum. Examination of North American water pennies, Psephenus herricki, which possess ventral tracheal gills leads us to suggest that suction through slots between the lateral laminae may be the only means of maintaining adequate water flow over the gills in these larvae, with the added benefit of maintaining a stable boundary layer above the laminae.

IS TASMANIA STRANGE? AN AQUATIC ENTOMOLOGICAL VIEWPOINT.

Ian Campbell. Centre for Water Studies, Caulfield Institute of Technology.

Recent studies on the taxonomy and distributions of aquatic insects are revealing distribution patterns which are very different to those of the terrestrial biota and even other aquatic forms. A number of taxa are found in New Zealand, and are widespread in eastern Australia, are absent from 'South Dingoland', although there are some surprising exceptions. Known patterns amongst the Ephemeroptera, Plecoptera, Trichoptera Odonata and some aquatic Diptera are compared and discussed.

OBSERVATION ON THE PHYSIOLOGY OF THE FRESHWATER CRAYFISH EUASTACUS ARMATUS AND CHERAX DESTRUCTOR.

Ross Kaires, Zoology Department, University of Adelaide.

The two species occur sympatrically throughout the Murray-Darling river system, but during this century Euastacus has disappeared from the River Murray in South Australia. Salinity was investigated as the possible causal factor because of its steady increase in the lower Murray over recent years.

Euastacus and Cherax were compared for the effects of salinity on aspects of osmotic regulation, ionic regulation and respiration. Results indicated salinity to have only a minor affect on the range reduction of Euastacus. Other possible causes are discussed.

RESPONSES OF PARASTACOIDES TASMANICUS TO LOW OXYGEN CONDITIONS.

Philip Fradd, Zoology Department, University of Tasmania.

Parastacoides tasmanicus has several adaptations which allow it to survive chronic low oxygen concentrations. It reduces its activity to reduce its oxygen requirements at low oxygen concentrations, but if it is unable to supply its energy needs by aerobic respiration, in water, it can (a) leave the water and respire in air or (b) respire partially aerobically and partially anaerobically, excreting lactic acid that is produced. At extremely low oxygen concentrations it cannot excrete lactic acid, but it can accumulate considerable quantities without harm. When oxygen levels increase sufficiently the stored lactic acid is rapidly excreted.

FAUNA AND ECOLOGY OF GRANITE ROCK POOLS AND OTHER SMALL WATER BODIES IN THE FAR SOUTH OF WESTERN AUSTRALIA.

Ian A.E. Bayly, Zoology Department, Monash University.

The nature of the microfauna, the pattern of succession, and the salient physico-chemical features of a series of 12 temporary ponds near Northcliffe, W.A., was studied in June and July 1977. The waters fell into two series: six very shallow granite rock pools, and six, somewhat deeper, temporary ponds and pools which were not resting on granite. Features of interest included the common occurrence of true aquatic oribatid mites, Neothrix, Cypretta and Illyodromus in the granite pools. Except for a few harpacticoids in one pool only, copepods were absent. In the non-granite waters copepods were common and abundant and Hemiboeckella searli and H. andersonae appeared early in the

succession. It may be ecologically significant that the latter two species show strong sexual dimorphism in size.

ARTIFICIAL OBSTRUCTION OF THE MIGRATION OF AUSTRALIAN BASS

John Harris, School of Zoology, University of New England.

A brief survey of waters within the range of the Australian bass (Macquaria novemaculata) has been made as part of a research program on the biology and ecology of the species.

Obstruction to fish migration by man-made structures is widespread. Dams, weirs, barrages and causeways have been built for many purposes in most of the drainage systems. Fishway facilities are incorporated in very few of them.

A classified listing of structures is presented, and an assessment made of their relevance, in the light of details of the migratory patterns of Australian bass.

DETERMINATION OF POLLUTION OF THE SOUTH ESK RIVER (NORTH EAST TASMANIA).

R.H. Norris, National Museum of Victoria, Melbourne.

The natural background levels of Cd, Zn, Cu and Pb in the South Esk River have been found to be low or below the detection limits. In the contaminated section of river the concentrations of these four metals in the sediments, non-filtrable residue (N.F.R.) and in solution were all well above the natural background levels but below environmental standards up to 130 km from the effluent flow.

No recovery was evident in the absolute numbers of animals and the numbers of species as far as 80 km downstream from the inflow of trace metals. A leptocerid caddisfly and a baetid mayfly were the only two species which maintained high numbers at sites above and below the pollution inflow. Several species which were numerically dominant at the uncontaminated sites were almost, or completely eliminated at sites below the inflow of metals. These included two mollusc species, four species of leptophlebiid mayflies and five species of caddisflies.

The concentrations of trace metals recorded from the water of the South Esk when compared with required environmental standards indicate that the South Esk would not be considered polluted. However, the

biological data indicates extensive detrimental effects due to the influx of trace metals. There is no doubt, in terms of the Tasmanian Environmental Protection Act definition of pollution that the South Esk River is seriously polluted by trace metals.

MERCURY IN RASPBERRY CREEK

G.F. Duke and R. Gaymer. Environmental Studies Department, Rusden State College.

The presence of mercury in Raspberry Creek, some 184 km northeast of Melbourne, is of potential concern because of fishing in the region. Very high levels are detectable in stream sediments at the A1 Gold Mine, and elevated levels persist in the sediments and macro-invertebrates for several kilometres downstream. Methyl mercury is detectable in sediments, fish and some invertebrates, but at much lower levels. The creek supports a rich, quite diverse fauna, which is affected at and below the mine site, but there is no evidence to link the changes with mercury contamination. There is also no evidence that natural levels of mercury and other metals are exceeded away from the stream, although raised levels were detected at an abandoned cinnabar mine.

A STUDY OF BENTHIC MACROINVERTEBRATES IN THE MITCHELL AND WENTWORTH RIVERS.

John Blyth, National Museum of Victoria, Melbourne.

A quantitative survey of benthic macroinvertebrate communities was carried out over three seasons at five sites on the Mitchell River and two sites on the Wentworth in the vicinity of Tabberabbera, Victoria.

Fifteen samples of 0.05 m^2 were taken at each site, using a modified Surber sampler.

A combination of statistical analyses of numbers of species and numbers of individuals, distribution of particular species and families between sites and habitats, and analysis of community composition and diversity was applied to the data.

Numbers of families collected per site in a single season varied from 30-50, and numbers of species from 60 to 120. Overall mean numbers of animals per square metre was from 4,380 to 5,540. The taxa Oligochaeta, Baetidae, Leptophlebiidae, Gripopterygidae, Elmidae, Leptoceridae, Simuliidae and Chironomidae provided over 66% of total animals in all collections, while thirteen common species contributed over 50% of such

totals. In particular, the mayfly, Atalophlebioides sp.1, and a leptocerid caddis-fly were numerically dominant at all sites.

Differences in fauna between the two rivers, gradational changes along their length, differences between sites based on variability of habitat, and seasonal changes, were observed.

NEW APPROACHES TO THE TAXONOMY OF THE TASMANIAN GALAXIIDS

C.J. Johnson and R.W.G. White, Department of Zoology, University of Tasmania.

Our recent studies of the relationships of the Tasmanian galaxiid fishes have involved karyology, multi-variate analyses of morphometric and meristic data and electrophoretic investigations of enzyme systems. The chromosome study has confirmed the "truttaceus" and "brevipinnis" groupings within the genus Galaxias. Step-wise canonical variates analysis of morphological features also confirms these groups and identifies two 'associations' with the genus Paragalaxias. Whilst these results for Paragalaxias are confirmed by principal co-ordinate and clusters analyses those for Galaxias are only partially supported. The electrophoretic studies of muscle esterases have confirmed the closeness of G. auratus with G. truttaceus and have established the presence of two isozyme polymorphisms which should be useful 'labels' for population studies.

HEAVY METAL POLLUTION AND THE FAUNA OF THE KING RIVER.

R.W.G. White, R. Swain, D. Coleman and M.E. Hortle., Department of Zoology, University of Tasmania.

The benthic, drift and fish faunas of the King River, Tasmania were studied in relation to the pollution of the habitat by copper, zinc and manganese from past and present mining activities. The benthic fauna was impoverished, in both number of species and total numbers, below the inflows of the polluted Comstock and Linda Creeks, The inflow of Comstock Creek appeared to induce a behavioural change in the drifting animals causing them to leave the drift and perhaps to move across the bottom of the river from an area of 'dirty' water to one of 'clean' water. No fish were found in the King River below the inflow of Comstock Creek. The 'background' levels of Cu, Zn and Mn in the muscle and liver of brown trout (Salmo trutta) from various parts of the King River catchment were determined.

BULLETIN

The Bulletin of the Australian Society for Limnology No. 7 was published earlier this year. This was the first issue to be published for some years. The future viability of the Bulletin depends on it being published regularly with good quality papers; and this, therefore, depends on the membership. If the Society wishes to have the Bulletin members must be prepared to submit papers which they might otherwise send to other journals.

The next issue of the Bulletin will be edited by Robert White with assistance from Peter Tyler and Alastair Richardson. Manuscripts should be sent to Robert White at the address given on page 2 of this Newsletter. All papers will be refereed.

The Editor of the Newsletter will be willing to publish correspondence from members on the role of the Bulletin.

The Secretary still has a good stock of earlier issues of the Bulletin. They may be purchased from him at a cost of $1.00 per copy plus postage. Cheques should be made payable to the Australian Society for Limnology.

BOOK REVIEWS

AUSTRALIAN FRESHWATER LIFE. THE INVERTEBRATES OF AUSTRALIAN INLAND WATERS by W.D. Williams. 321 pp. MacMillan, Melbourne. Hard cover $29.95 , soft cover $14.95.

Reviewed by P.S. Lake.

In many ways this book is more than simply a second edition of Williams (1968). The differences between the two editions range from relatively minor ones such as a vastly improved cover design featuring that noble denizen of muddy rivers the Murray River crayfish, Euastacus armatus, to such major ones as much improved, much more comprehensive accounts of many groups.

There is no doubt that for secondary and tertiary level biology courses Williams (1968) fulfilled a most valuable function. Indeed the availability of such a book for freshwater biologists as opposed to the lack of such a book for Australian terrestrial faunas and marine faunas may partly explain the popularity of limnology in Australia, a popularity achieved despite its cinderella status in academic and government circles in Australia. Officially endorsed animal ecology in Australia is concerned with the vagaries of terrestrial pests, terrestrial fauna control and management and the opening up of marine resources in the 200 mile limit.

It is safe to say that Williams (1980) will be an invaluable book for those secondary and tertiary level biology courses which lead students to fresh waters. It will also be a most useful book

for the not inconsiderable number of non-professional limnologists in Australia (the word amateur in this context has unfortunate connotations), be they anglers, irrigation managers, even engineers, as well as to fully-fledged professional limnologists. For the latter engaged in field work the book will allow basic identifications to be made. Then by following up the numerous references cited in the book more definitive diagnoses can be made. Indeed the comprehensive list of references for each taxonomic grouping is a particular strength of the book.

Chapter I outlines the types of inland water bodies to be found in Australia and defines the communities that one can expect to find in the water bodies. Lentic water bodies and their communities are adequately discussed and it is refreshing to see that lotic systems are given some attention. Whether the rhithron/potamon division of stream communities sould have been given the prominence shown to it is open to question. We await the publication of work in Victoria and Tasmania to help us make up our minds on the validity of the division - at least for Australian conditions. Possibly the hyporheos community of streams could have been mentioned as this community is almost totally neglected in Australia, yet preliminary proddings have produced such interesting animals as interstitial syncarids.

The key purpose of the book is to assist people to identify freshwater animals. It will be used by many students and there is no doubt that textbooks and field guides convey attitudes of scientific investigation to the students. From use of this book students will learn the value of careful observation and logical thinking in using keys but I am afraid that they will not be urged to do field work quantitatively. In defence the book is not designed with this purpose as one of its goals. For teachers of limnology, in order to give students an appreciation of the quantitative aspects of limnology, Williams (1980) could be used

in collaboration with Elliott (1977) and the excellent recent book by Green (1980) "Sampling Design and Statistical Methods for Environmental Biologists".

In comparison with Williams (1968) the new edition is longer (262 pages (1968) and 321 pages (1980)), has a greater number of illustrations, and most importantly, gives much fuller and precise accounts of many groups of animals. Our knowledge of many groups of Australian freshwater invertebrates has improved considerably since 1968. This improvement is reflected in the book by comprehensive accounts of such groups as the Porifera, Rotifera, Hirudinea, Crustacea (notably Cladocera, Ostracoda, Copepoda, Syncarida), Plecoptera, Ephemeroptera, Hemiptera, and Trichoptera. The book also highlights areas of taxonomic neglect where eager young taxonomists could be advised to venture. Such groups include the Oligochaeta, Hydracarina, Conchostraca, Neuroptera, Diptera (especially Tipulidae, Simuliidae, Chaoborinae, Psychodidae, Chironomidae), the Coleoptera and, strangely, in view of the good state of the adult taxonomy, nymphal Odonata. The Coleoptera, as I know from experience, greatly need some attention, especially the Hydrophilidae.

The astute reader may have noticed that so far I have omitted the Mollusca from my discussion. The reason is simple. Recently the "Field Guide to the Non-Marine Molluscs of South-eastern Australia" by B.J. Smith and R.C. Kershaw was published; this guide differs substantially from Williams (1980) in the taxonomy of freshwater molluscs especially freshwater gastropods. For example in Williams (1980) generic key to the gastropods Glacidorbis is not present. Glacidorbis hedleyi is widespread in alpine streams and bogs of Victoria and southern New South Wales. For readers in south-eastern Australia, the two field guides must be used together.

Most of the illustrations are clear and are well labelled. Some however, for example Figures 31, 35, 52, 53, 54, 59, 73, 100 and 101; suffer from being too small and difficulties in interpreting the figures may arise for students. In the beetles a clear figure illustrating the differences between fore coxal cavities which are either open or closed behind would be most useful. Misprints and errors are very few; however, an error that could be a nuisance is in couplet 8 of the key to families of adult coleopterans.

A considerable improvement has been made in the binding of the book, in comparison with the 1968 edition. In the latter, upon opening the pages for the first time, it became a loose leaf edition. Publishers of field guides would do well to follow the step taken by the South Australian Government Printer in publishing the second and third editions of "The Marine and Freshwater Fishes of South Australia" - to use paper coated with a polypropylene film. All field guides get wet, but with a plastic-coated paper they can last longer.

For south-eastern Australia our knowledge of the taxonomy of freshwater animals is quite good. Indeed with Williams (1980), Smith and Kershaw (1979), McDowall (1980) ("Freshwater Fishes of South-eastern Australia") and Barker and Grigg (1977) (Field Guide to Australian Frogs") one is well equipped to identify most macroscopic freshwater animals of south-eastern Australia.

In summary, the second edition of "Australian Freshwater Life" is a most useful addition to the essential books of Australian limnology. It will serve a most valuable purpose in the teaching and furtherance of our knowledge of Australia's freshwater fauna. Hopefully it will serve as a goading guide for limnological taxonomists eager to tackle neglected groups.

FRESHWATER FISHES OF SOUTH-EASTERN AUSTRALIA (New South Wales, Victoria and Tasmania. Edited by R.M. McDowall, 208 pp. A.H. and A.W. Reed Pty. Ltd., Sydney. Hard cover $19.95.

Reviewed by Gary N. Backhouse.

There has long been the need for an accurate, authoritative guide to the native and introduced freshwater fishes of Australia. Previous books on the subject (Lake 1971, 1978; Whitley 1960) have attempted to cover the entire field of Australian freshwater fishes, and have generally reflected the overall paucity of knowledge on the subject. This present book goes a long way towards filling part of the large gap in our general knowledge of the freshwater fishes of this continent.

The book is the result of the combined efforts of 18 contributing authors, including Dr. McDowall, all of whom are specialists in their respective fields. It is 208 pages in length, has a hard cover, and has a sewn binding. Page size is 18 cm X 24.5 cm. There are 33 chapters, covering 29 families and 91 species of freshwater fishes. A colour plate section with 74 colour photographs illustrates most of the species discussed. The book is priced at $19.95 retail.

Preceding Chapter 1 is a map of the area covered (southern Queensland, New South Wales, Victoria, Tasmania and south-eastern South Australia); a foreward by D.F. Waterhouse, Chairman of the Interim Council, Australian Biological Resources Study; and a preface by Dr. McDowall, indicating the background of the book and listing the contributing scientists. Chapter 1 takes the form of an introduction to the book, briefly outlining the aims and audience of the book, and outlining the format of the following chapters.

Chapter 2 is entitled "Studying fishes" and give information on taxonomy and preservation of fishes, and on how to use a key. A glossary of terms used throughout the book then follows.

The third chapter is an illustrated key to the families of fishes encountered in freshwater in south-eastern Australia, including those fishes that regularly and normally occur in freshwater, and also those that are occasional invaders of fresh waters. The key covers lampreys, sharks, rays and bony fishes, a total of 45 families.

Chapter 4 to 32 deal with the families of fishes covered by the book, one chapter per family, covering 29 families and 91 species. The colour plates occur together in a section from pp. 97-128, between chapters 18 and 19.

Chapter 33 is a list and brief discussion of other species that may occasionally enter fresh waters. Following this chapter are the reference section and index.

Initial impressions were very good, as the book has a lot of appeal. The hard cover and attractive cover photograph catch and hold the eye quickly. The text and illustrations are well laid-out, designed and easily read. The book is generally well illustrated, and many fishes can be rapidly identified by immediate reference to the colour photograph section. The positioning of the illustrated glossary before the species discussions enables readers to familiarize themselves with unfamiliar terms before reading the bulk of the text. The division of the species discussions into numerous sub-headings makes the task of those readers seeking specific information much easier. The descriptions of the species are generally fairly concise and easily understood, and a great deal of biological information, especially on some of the less well known species, usually accompanies the descriptions. Features used in the inter- and intra-familial keys are generally easily and readily observed, facilitating rapid identification. The reference section is quite extensive, covering most of the important papers concerned with the Australian ichthyofauna.

Special mention should be made of the illustrations by Dr.McDowall, especially those in the galaxiid chapter (Chapter 10). They are highly detailed and of superb quality and accuracy. Helen Larson's illustrations in the chapters on gudgeons and gobies (Chapter 31 and 32) are also very detailed and finely done. The colour plate section contains some very good photos, especially those of Gunter Schmida, who must rank as one of the finest fish photographers in the world.

However, in spite of these very good qualities, the book has many mistakes, which greatly detract from its initial overall appeal. Two comments can be made about the family key (Chapter 3). The key feature for the family Bovichthyidae (page 32) is obviously wrong if one examines the drawing accompanying the key, and the photograph on page 123. Following the key using this feature could lead to considerable confusion in trying to key out a bovichthyid fish or any of the 15 families following. I also feel that the key features for the family Percichthyidae (page 36) are poor. There are 6 species of percichthyid fishes in the book, yet none of the 3 features used in the key apply to all of the 6 species. In fact, both the estuary perch and Australian bass key out closer to the Teraponidae (page 37) than they do to the Percichthyidae.

The intra-familial key to the Clupeidae (page 48) lists the correct features for both species of clupeid, yet these features are reversed in the species descriptions.

The western chanda perch is described and figured on page 140. The figure, unfortunately, is not of this species, but is, in fact, an unrelated marine species, the silverbelly (Parequula melbournensis - Family Gerridae; see Scott et al (1974), page 223, for the correct illustration).

Although the colour photographs are generally quite good, a recurring fault with many fish photographs is the poor framing of the subject and consequent lack of a tail in the picture. Several species are illustrated in this manner. The purple-spotted gudgeon

(top of page 125) again fares badly. John Lake's (1978) book featured a poor, out-of-focus, photograph of this species, and this book is no exception with the photograph featured of the fish.

One problem accompanying any book by multiple contributing authors would be ensuring consistency throughout the individual contributions. Several examples of an obvious lack of consistency are evident throughout the book. The detail in the "Description" sub-heading of the species discussions varies greatly; some are very well done with a lot of detail e.g. western carp gudgeon (page 182), while others are reduced to only a few lines, and are very sketchy e.g. freshwater herring (page 49).

It is a pity that the illustrations accompanying the species discussions were not mainly from the one source. The book would have been greatly enhanced if all the figures were of the quality of McDowall and Larson's work. Several species are poorly illustrates, while the dorsal view of the head of the lesser salmon catfish (page 89) gives us no idea of what the fish actually looks like, especially since there is no photograph, and the only diagram supplied accompanies the inter-familial key (page 27).

One would hope that a book of this calibre would help disperse the taxonomic fog that has surrounded many of our native fishes recently. While this is true of families such as the Galaxiidae (pp. 55-69) and the Percichthyidae (pp. 142-149), several other quite confusing aspects arise as a result of this book. Again, lack of consistency amongst contributing authors may be partly to blame. One comment concerning the river blackfish on page 161 is worth repeating: "Some controversy about the number of species of blackfish with unpublished evidence suggesting a distinct Tasmanian species..... A name occurs in the literature for the Tasmanian species but should not be used until the species is formally described". Against this view there are what appear to be seemingly arbitrary changes in the taxonomy of two species, the Mitchelian freshwater hardyhead (page 134) and the Yarra pigmy perch (page 155). The Mitchellian freshwater hardyhead, formerly known as Craterocephalus fluviatilis (Lake 1971, 1978; Scott et al 1974; Whitley 1960), appears in the book as "the non-speckled subspecies

of C. stercusmuscarum". The Yarra pigmy perch has the scientific name of Nannoperca obscura, with the accompanying comment: "Often included in the genus Edelia". In practically all previous publications where the species has been listed, it has been placed in the genus Edelia (Barnham 1978; Lake 1971, 1978; Llewellyn 1974; Scott et al 1974; Whitley 1960). I know of no subsequent formal scientific publications relating these changes to any taxonomic investigation.

Two previously undescribed Hypseleotris gudgeons are described (pp. 183-185) in some detail in the book. The legitimacy of this section is open to question, since the new species have not been formally described, and especially since the taxonomy of the "western carp gudgeon" complex is far from clear. Taking into account the descriptions and figures of the three Hypseleotris spp., the photograph on page 126, labelled as "H. klunzingeri" is not of this species, but more closely resembles Lake's carp gudgeon (p.184). The inclusion of a diagram of the head papillae of Midgley's carp gudgeon (p.183) would have been a great asset as an aid to identification of this form.

The book would have greatly benefited from the inclusion of distribution maps delineating the species' ranges. Although, by their nature, they would probably not be completely accurate, the maps could avoid the confusion that arises due to incomplete or unclear statements on a species' distribution. Several major errors occur in several species' distributions in Victoria. The Mitchellian freshwater hardyhead, the bridled goby, and the western carp gudgeon are all found in Victoria (Barnham 1978; Scott et al 1974) yet no mention is made in the book of the Victorian distributions of these species. The empirefish (pp. 179-80) is stated as being "relatively common at low altitudes in coastal streams of Victoria....", yet no specimens or positive distribution records exist for this state. There are many other minor errors in stated Victorian distributions, and this could equally apply to other states. The reader is referred to the following references for a more complete picture of Victorian distributions, but there are some errors in these as well (Backhouse and Gooley 1979, Barnham 1978, Scott et al 1974, Tunbridge and Rogan

1976).

The distribution of the Yarra pigmy perch (page 155) requires some comment. Firstly, the Eumeralla River in Victoria flows near Yambuck, not Yambah (which is in the Northern Territory) and secondly, the reported distribution - "....Yarra River....." and "..... Eumeralla River....." seems to contradict the statement in the Description: "in fish collected from some Victorian and South Australian rivers, may indicate interbreeding between southern and Yarra pigmy perches". One would assume that, if "hybrids" do exist in South Australia, then both parent species would need to be present. Actually the species has been recorded in South Australia (Scott et al 1974). Also, I believe that the specimen in the photograph (page 119) is from the Deep Creek, east of Lancefield, Vic., yet no mention of this is made in the Distribution.

When a species distribution is described, place names quoted should occur on the map covering the area, yet repeatedly I came across place names in the text not marked on the map.

Unfortunately space precludes the detailing of the many small errors that occur, but the reader should be aware of the diagrammatical error on p.35, the incorrect labelling to illustrations on pp. 71 and 76, and the recent alteration of the rainbowfish genus Nematocentris to Melanotaenia (Allen 1978). Also, several families of fishes listed in Chapter 33 do not appear in the key in Chapter 3.

In spite of these criticisms, however, the book does break new ground on the subject of Australian freshwater fishes. A wealth of information is presented within the covers, and it is the first time that the subject has been treated in such length and breadth. It is certainly a worthwhile addition to the library of anyone, be they angler, aquarist or scientist, with any interest in Australian freshwater fishes. I look forward to reading the revised second edition in the near future.

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